Oreamnos Rafinesque, 1817

Oreamnos Rafinesque, 1817,2:44. Type species *Mazama dorsata* Rafinesque, 1817, by monotypy.

Aplocerus C. H. Smith [= H. Smith or Hamilton-Smith], *in* Griffith, 1827, 5:354. Type species, *Antilope lanigera* C. H. Smith, 1822, by monotypy.

Haplocerus Wagner, *in* Schreber, 1844,4:462. Renaming of *Aplocerus* C. H. Smith, 1827.

Haploceros Flower and Garson, 1884,2:257. Renaming of *Haplocerus* Wagner, 1844.

Oreamnus Elliot, 1901:44. Renaming of *Oreamnos* Rafinesque, 1817.

CONTEXT AND CONTENT. Order Artiodactyla, Suborder Ruminantia, Infraorder Pecora, Family Bovidae, Subfamily Caprinae, Tribe Rupicaprini. The rupicaprines, or goat-antelopes, include, in addition to *Oreamnos*, the Recent Old World genera *Capricornis, Naemorhedus, Rupicapra* (Dolan, 1963), and perhaps *Budorcas* (Pocock, 1910, 1913; see Sokolov, 1959, for a contrary view). *Oreamnos* includes one living, and one extinct species (*O. harringtoni*).

Oreamnos americanus (Blainville, 1816)
Mountain goat, White goat, Snow goat

Ovis montanus Ord, 1815,2:292. Preoccupied by *Ovis montana* Schreber (= *Ovis canadensis* Shaw, the Rocky Mountain bighorn sheep).

R[upicapra] americana Blainville, 1816:80. Type locality restricted to Cascade Range in Oregon or Washington by Hollister, 1912; regarded as "probably near Mt. Adams, Washington" by Dalquest, 1948.

Mazama dorsata Rafinesque, 1817,2:44. Renaming of *Ovis montanus* Ord, 1815.

Mazama sericea Rafinesque, 1817,2:44. Renaming of *Rupicapra americana* Blainville, 1816.

Antilope lanigera C. H. Smith, 1822:38. Renaming of *Rupicapra americana* Blainville, 1816.

Capra columbiana Desmoulins, 1823,3:580. Renaming of *Rupicapra americana* Blainville, 1816.

Oreamnus kennedyi Elliot, 1900:3. Type locality, mountains at mouth of Copper River, opposite Kayak Island, Alaska.

Oreamnos americanus (Blainville, 1816). First use of combination (Hollister, 1912).

CONTEXT AND CONTENT. Context noted in generic account above. Four subspecies have been named, but were combined by Cowan and McCrory (1970).

O. a. americanus (Blainville, 1816), see above.

O. a. kennedyi (Elliot, 1900), see above.

O. a. missoulae Allen, 1904:20. Type locality Missoula County, Montana.

O. a. columbiae Hollister, 1912:186. Type locality Shesley Mts., British Columbia. Renaming of *Oreamnos montanus columbianus* Allen, 1904:20, preoccupied by *Capra columbiana* Desmoulins, 1823.

DIAGNOSIS. The coat consists of white wool interspersed with guard hairs in both sexes. The black, slightly curved horns are 8 to 10 inches (203 to 254 mm) long in adults. The only other North American bovid with white pelage is the thin-horned, or Dall's sheep (*Ovis dalli*). Although males of Dall's sheep bear large spiral horns, females have tan-colored horns that approximate those of the mountain goat in size and shape. Mountain goats have been confused with ewes of mountain sheep (*Ovis canadensis*), but the sheep can be distinguished easily by their tan-colored horns and brown coat. For cranial differences between mountain goats and mountain sheep see section on Form.

GENERAL CHARACTERS. The mountain goat is stocky, with a slender neck, thin black horns, and a short tail (figure 1). Its pelage consists of white wool and guard hairs, often with scattered dark brown hairs on back and rump (Seton, 1929), sometimes forming a "clearly defined dark brown line" (Grant, 1905), and including a pointed beard approximately 5 inches (130 mm) in length. The winter coat often appears yellowish, especially shortly before it is shed in the spring. The feet are larger than those of mountain sheep, with oval hooves and prominent dew "claws." Mountain goats consequently are able to traverse weaker snow crusts than are mountain sheep (Geist, 1971).

Measurements of adult males (Hall and Kelson, 1959; Brandborg, 1955; Hollister, 1912) range as follows (all linear measurements in millimeters): total length, 1245 to 1787; length of tail, 84 to 203; length of hind foot, 300 to 368; weight, 46.2 to 136.0 kg (102 to 300 lbs.). Males exceed females in linear measurements by 10 to 30%. Horns may reach a length of 305 mm in both sexes (Cowan and Guiguet, 1960).

Unlike the heavy skulls of wild sheep, the skull of the mountain goat is light and fragile (figure 2). Hall and Kelson (1959) gave the following measurements (in millimeters): Basal length of skull (measurement A in figure 2), 270 to 293; occipitonasal length (B), 299 to 336; interorbital breadth (C), 95 to 98; palatilar length (D), 176 to 184; length of maxillary toothrow (E), 69 to 77.

FIGURE 1. Mountain goats photographed in Glacier National Park, Montana, in August 1969, by C. B. Rideout. The female is in summer pelage and the kid is about two months old.
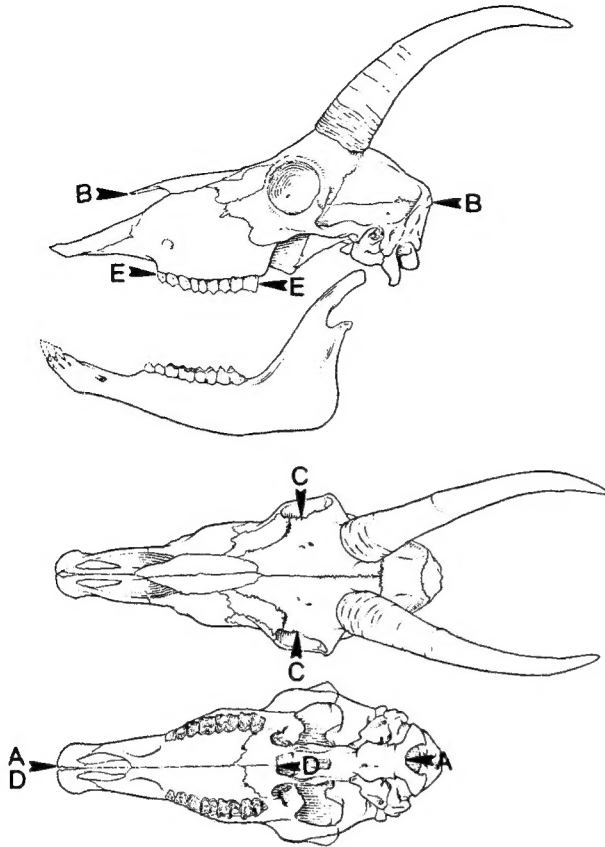
FIGURE 2. Skull of female *Oreamnos americanus* from Tcho Park Mtns., Washington (University of Kansas no. 1885; from Hall and Kelson, 1959:1027, by permission of Ronald Press Inc., New York). From top to bottom; lateral, dorsal, and ventral views of skull. Dimensions labeled are given in text.

DISTRIBUTION. The native range of the mountain goat extends from western Montana, southern Idaho, and the Columbia River in Washington north along the Rocky Mountains as far as the Chugach and Talkeetna mountains of Alaska (figure 3). Mountain goats occupy alpine and subalpine areas having steep rocky terrain, and their distribution includes most of the major ranges of the Coast, Cascade, and Rocky mountains within the north-south limits given above. Mountain ranges isolated from the main ranges by unsuitable lowland habitat were unoccupied prior to the 1930's but goats have now been introduced successfully into many of them (see map, figure 3). For further information on introductions see section on Ecology.

FOSSIL RECORD. *Oreamnos* first appeared in North America during the Wisconsin glaciation, presumably being derived from rupricaprine ancestors who crossed the Bering Land Bridge from Asia. At the height of the Wisconsin glaciation, mountain goats were forced into a southern refugium south of the Cordilleran ice cap, and it is thought that none existed in the northern refugium in Alaska during this time (Hoffmann and Taber, 1967; Cowan and McCrory, 1970). Fossil remains of the smaller *Oreamnos harringtoni* from the Quaternary have been found in Smith Creek Cave, Nevada (Stock, 1936), Rampart Cave, Nevada, and San Josecito Cave in Neuvo León, México (Wilson, 1942). Fossils of *O. americanus* have been described from Washtuckna Lake, Washington (Matthew, 1902), Samwell Cave, California (Stock, 1918), and Potter Creek Cave, California (Sinclair, 1905). It is likely that *O. americanus* died out in southern montane areas in the warm Hypsithermal period following the Wisconsin glaciation (Hoffmann and Taber, 1967).

FORM. Adult males begin shedding in June, and the molt is usually complete by the middle of July. Females and yearlings complete their molt later, by mid-August (Brandborg, 1955). The skin of the mountain goat varies in thickness over its body, especially in adult males. During lateral displays blows are most frequently delivered to the flanks (see section
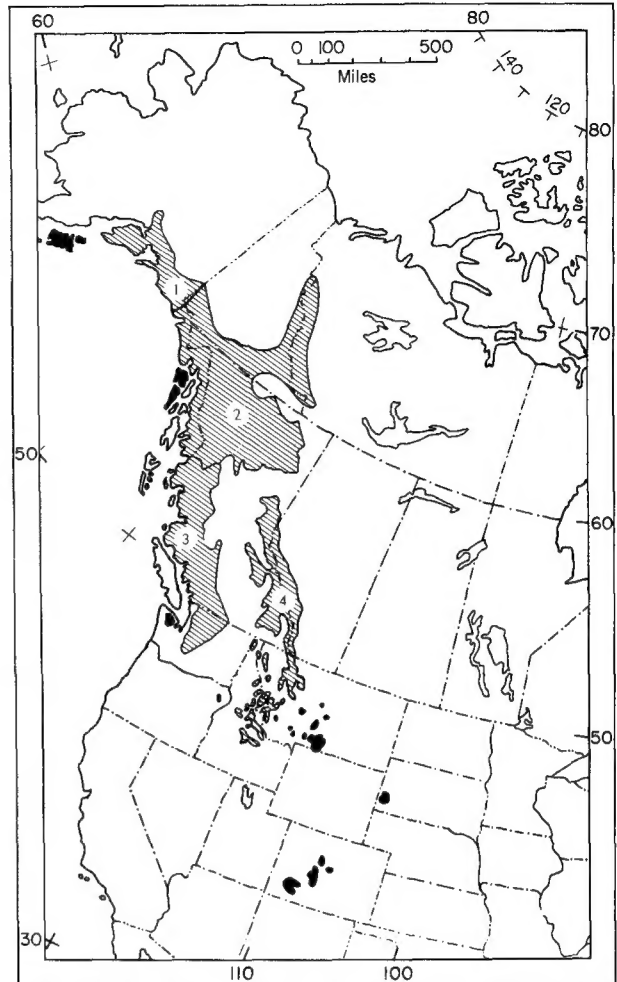

FIGURE 3. Distribution map of *Oreamnos americanus*. Shaded areas denote native ranges, which are still occupied; black areas show introduced herds. Ranges of subspecies formerly recognized are (1) *O. a. kennedyi*, (2) *O. a. columbianus*, (3) *O. a. americanus*, and (4) *O. a. missoulae*. Figure prepared by T. Swearingen.

on Behavior). The wounds that result are commonly received on the ventral and posterior skin surface, which is thickest. In old males this dermal shield may be as much as 22 mm in thickness (Geist, 1967, 1971).

A black, crescent-shaped gland is found immediately behind the horns in both sexes of the mountain goat. The horn glands of a male captured on 14 November 1972 by one of us (Rideout) were much enlarged, and the exudate of the glands was visible on the posterior surfaces of the horns. During the rut males draw their heads through vegetation, thus scent-marking it with this secretion (Geist, 1964; DeBock, 1970).

The mountain goat and other rupricaprines have four teats, whereas the Caprini (sheep and goats) have only two (Geist, 1971). The cranial features of the Caprini differ from those of the Rupricaprini as follows: Caprini have: 1) larger horns; 2) much larger frontal bones, and reduced parietals; 3) a heightened skull, as measured from the vertex to the foramen magnum; 4) much expanded frontal and cornual sinuses; and 5) a basicranium that is bent in the area of the basioccipital-basisphenoid fusion, resulting in the rotation of posterior elements of the brain case ventrally. In the Rupricaprini, the sinuses are small and have no additional internal septa, and the cornual sinus exists only at the base of the horn core. Of the rupricaprines only the chamois (*Rupricapra rupricapra*) engages in head-to-head jousting; the tribe, including *O. americanus*, exhibits little sexual dimorphism (Schaffer and Reed, 1972).

Mountain goats can be aged by counting the annual rings around the horns. The first ring is formed in the second winter's growth at an age of between 22 and 24 months, and one is formed each subsequent spring. The dental formula in

the mountain goat is i 0/3, c 0/1, p 3/3, m 3/3, a total of 32. Mountain goat kids are born with 18 milk teeth, lacking deciduous incisiform canines. The i1 pair of incisors is replaced at 15 to 16 months of age, followed by the replacement of the i2 incisors at year 2 and the i3 incisors at year 3. The deciduous incisiform canines are replaced during the summer and fall beginning year 5 (Brandborg, 1955; Greer, 1971). Animals after the third year may best be aged by counting horn rings, because patterns of tooth wear have not yet been described.

FUNCTION. The metabolism of a yearling mountain goat captured near Anchorage, Alaska, was measured (Krog and Monson, 1954). Oxygen consumption remained fairly constant within a temperature range of 20°C to −20°C, the mean value being 260 mm^3 O$_2$/g/hr. At −30°C the oxygen consumption increased by approximately 23%, and at −50°C by about 130%. The authors concluded that the mountain goat's pelage does not provide as much insulation as does the coat of true Arctic mammals, but noted that the critical temperature (just below −20°C) is the lowest temperature reached in the mountain ranges of Alaska that are occupied by mountain goats.

ONTOGENY AND REPRODUCTION. DeBock (1970) observed the rut in Kootenay National Park (Alberta) between 3 November and the second week of December. Geist (1964) reported 2 November as the beginning of the rut, but observed matings as late as 3 January. The gestation period was reported to be 147 days by Asdell (1964), and 178 days by Brandborg (1955). The testes produce active sperm at month 30, and females breed at the same age (Asdell, 1964).

Mountain goat kids frequently are born in late May or early June, starting as early as 20 May (Anderson, 1940); single births are most common, although twins are not uncommon, and several sets of triplets were reported by Lentfer (1955) during the rapid population growth following the introduction of mountain goats into the Crazy Mountains of Montana.

A newborn kid in Montana weighed 2.95 kg (6.5 lbs.), measured 22 inches (559 mm) in total length, and was 13.5 inches (343 mm) high at the shoulder. A mountain goat fetus taken from a female in Idaho near the Salmon River weighed 3.2 lbs. (1.45 kg) 6 to 10 weeks prior to parturition (Brandborg, 1955). Kids closely resemble domestic lambs, except that the coat is more nearly white and the ears are narrower and more pointed. A dark ash-brown band extends dorsally from the neck to the tail on most kids (Cowan and Guiguet, 1960); it is absent in most yearlings (Hanson, 1950). Kids are precocial, and the female usually gives birth on steep cliffs. In the first week of life kids follow the mother closely, and nurse at hourly intervals. Some females still produce milk in September, but apparently are nearing the end of lactation (Brandborg, 1955). The young goat usually remains with the mother until a new kid is born, but is then driven away by the mother (DeBock, 1970).

Brandborg (1955) reported a male 13 years old, and Richardson (1971) reported another 11 years old and a female 10 years old. The oldest individuals represented among 165 skulls examined by Cowan and McCrory (1970) were an 18-year-old female and a 14-year-old male.

ECOLOGY. Predators of the mountain goat include the cougar (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), golden eagle (*Aquila chrysaetos*), and both black and grizzly bears (*Ursus americanus, U. arctos*). The cougar is probably the most serious of these, inasmuch as it can traverse rugged terrain and is large enough to attack and kill an adult mountain goat. Young and Goldman (1946:95) cited one eyewitness account of a cougar killing a mountain goat, and Hornocker (1970) reported another case of cougar predation.

Mountain goat wool frequently is found in coyote scats, but probably is attributable to scavenging by the coyote. Bears may occasionally catch goats when they are not on cliffs, but would most likely be unable to capture a goat in good condition in rugged terrain. Eagles have been reported to carry off newborn kids (Brandborg, 1955), and to knock yearlings off cliffs (Anderson, 1940).

The most serious ectoparasite of the mountain goat is the wood tick (*Dermacentor andersoni*). Infestations of the winter tick (*Dermacentor albipictus*) are less common, as are lice (Cowan, 1951; Brandborg, 1955; Boddicker et al., 1971).

Two to 10 species of helminths were found in each of 28 mountain goats examined in the Black Hills (Boddicker et al.,

1971). Lungworms (*Protostrongylus stilesi* and *P. rushi*) and a nematode of the small intestine (*Nematodirus maculosus*) were present in heavy infections and the authors concluded that parasitism might be the primary check on mountain goat numbers in the Black Hills.

Hanson (1950) found 86 kids and 52 yearlings for each 100 females in the Black Hills, approximately 20 years after *Oreamnos* was introduced there. This is the highest ratio of young to adults reported. Petrides (1948) and Lentfer (1955) reported kid to adult ratios (both sexes included) of as low as 43:100 in Glacier Park and the Crazy Mountains of Montana respectively. Rideout (1974a) reported kid to female ratios of 77:100 to 84:100 in Montana, and Anderson (1940) found a kid to female ratio of 73:100 in Washington, whereas Cowan (1944) reported a kid to female ratio of only 45:100 in Jasper National Park, Alberta. A yearling to female ratio of 28:100 determined by Cowan at the same time indicated considerable mortality during the winter; a comparable decline (79 kids:100 females and 55 yearlings:100 females) during the winter of 1947 and 1948 in the Red Butte Range of Montana was reported by Brandborg (1955). Rideout (1974a) found greater mortality of kids and yearlings during a severe winter (73% and 59%, respectively) than during a mild winter (28% and 2%).

Cowan (1950) felt that accurate sex ratios could not be determined for mountain goats due to their inaccessibility during the rut and the solitary nature of the males in summer. It is also difficult to sex mountain goats in the field. Ratios of 87 and 73 males to 100 females (Brandborg, 1955), 74 males to 100 females (Cowan, 1950), and 87 males to 100 females (Anderson, 1940) have been reported; Chadwick (1973) and Rideout (1974a) found male to female ratios of 27:100 to 56:100 and 23:100 to 44:100, respectively, on Montana goat ranges. The largest male to female ratios followed mild winters, which indicated relatively higher male mortality during severe winters (Rideout, 1974a).

Cowan (1944) analyzed the stomach contents of five mountain goats killed in summer in Alberta and found 63% grasses and sedges, 14% herbaceous vegetation, and 23% willow. Klein (1953) also found mountain goats to be primarily grazers during the summer in Alaska, whereas Casebeer (1948) found grazing to be secondary in summer in Montana, 96% of the summer diet consisting of grouse whortleberry (*Vaccinium scoparium*).

The winter diet of mountain goats in the Black Hills was extremely variable (Harmon, 1944), consisting of approximately 60% mosses and lichens, 30% woody plants, and 10% miscellaneous vegetation. Anderson (1940) indicated that grasses, if available, may make up as much as 90% of the winter diet in Washington, whereas Klein (1953), Saunders (1955), and Casebeer (1948) found that shrubs comprised a small portion of the winter diet in Alaska and Montana. Casebeer (1948) found that beargrass (*Xerophyllum tenax*) was used heavily during the winter in Montana. Ponderosa pine (*Pinus ponderosa*) was used to some extent in winter in Montana and Alberta (Brandborg, 1955; Cowan, 1944), and Geist (1971) found that alpine fir (*Abies lasiocarpa*) formed 29.4% of the winter diet of mountain goats in British Columbia.

Water is not considered to be a limiting factor for mountain goat ranges in most parts of Montana because snowbanks are usually available there all year long, and goats have been observed eating snow (Lentfer, 1955). Brandborg (1955) found no evidence that goats travel daily to reach water in Idaho or Montana, but Anderson (1940) thought watering places limited the summer distribution of goats in Washington.

Salt licks are important to mountain goats in spring and summer, and they frequently travel several miles to reach licks (Cowan and Brink, 1949; Brandborg, 1955; Hebert and Cowan, 1971; Rideout, 1974a). Stockstad et al. (1953) tested mineral preferences and reported that sodium was favored by mountain goats in western Montana. Hebert and Cowan (1971) concluded that increased sodium consumption in spring and autumn was due to loss of sodium by the fecal route following a change in diet to new lush vegetation. Sodium concentrations of mountain goat licks in southeastern British Columbia ranged from 115 ppm to 5,500 ppm (Hebert and Cowan, 1971). Rideout (1974a) found that a salt lick in Montana contained 159 ppm of sodium, whereas Brandborg (1955) reported a lick in Idaho with only 20 ppm of sodium.

Mountain goat migrations between summer and winter ranges have been reported by Brandborg (1955), DeBock (1970), Peck (1972) and Rideout (1974a). South-facing and west-facing slopes are most frequently utilized in winter because they are often snowfree (Peck, 1972; Rideout, 1974a).

Although goats usually seek the lowest available slopes that provide steep rocky terrain and vetetative cover, they sometimes seek the highest ridges, where snow is removed by the wind (Brandborg, 1955; Chadwick, 1973).

Downward migrations coincide with the first heavy snowfalls at high altitudes. Migration to higher elevations in spring is gradual, and females with kids and yearlings are last to leave wintering areas (Brandborg, 1955). In Washington, migrations of 10 miles (16 km) have been reported (Anderson, 1940) and even greater distances may be covered in Idaho and Montana (Brandborg, 1955). Rideout (1974a) recorded migrations in Montana between summer and winter activity centers which varied from 1.7 to 11.1 km.

Daily movements range from a few hundred meters to 0.5 km according to Brandborg (1955). On one occasion he observed two males who travelled more than 2 miles (3.2 km) in one day. Holroyd (1967) stated that mountain goats can gain 1500 feet (460 m) in altitude in about 20 minutes with little apparent effort. Rideout (1974a) found mean yearly home ranges of 21.5 km² for adult males, 24.0 km² for adult females, 31.1 km² for two-year-olds, and 48.3 km² for yearlings in the Sapphire Mountains of Montana.

Mountain goats have been introduced into the Black Hills of South Dakota (Richardson, 1971; Hanson, 1950), several mountain ranges in Montana (Mussehl and Howell, 1971), the San Juan, Gore, and Collegiate ranges in Colorado (Hibbs et al., 1969), the Wallowa Mountains in Oregon (Mace, 1970), in Olympic National Park in Washington (Webster, 1932), on Vancouver Island, British Columbia (Munro, 1933), and on Baranof, Chichagof, and Kodiak islands in Alaska (Manville and Young, 1965). An attempt to introduce mountain goats into the Twin Peaks area of Utah apparently failed (Utah Department of Natural Resources, personal communication, April 1973), as did the introduction on Vancouver Island (Cowan and McCrory, 1970). The introduction on Kodiak Island has produced a population of low density (Manville and Young, 1965), as is true in the Wallowa Mountains of Oregon (Mace, 1970).

Mountain goat populations in Idaho and Montana have been decimated in recent years due to disturbance during and following road construction, and resultant easing of human access (S. Brandborg, personal communication, June 1972; Chadwick, 1973). Nevertheless, because of the remoteness of their habitat, mountain goats have suffered fewer losses to native populations than any other large North American game animal (Rideout, 1973).

The mountain goat has a poor record of longevity and reproduction in captivity. Individuals that escaped to form the nucleus of the Black Hills population did not thrive while confined (Hanson, 1950), and eight goats intended for transplantation in Wyoming died in captivity at the Sybille Wildlife Experimental Unit (Wyoming Fish and Game, personal communication, August 1973). Two kids were born at the New York Zoological Park and were raised to maturity, but keeping mountain goats in good health there has been difficult (Hornaday, 1928; Hanson, 1950).

The mountain goat is hunted primarily as a trophy animal; its meat is not popular. Introductions in Montana and Colorado were made with sport hunting in mind, and mountain goats are hunted, usually on a special permit basis, in most areas of their range.

Mountain goats have been captured by means of Clover deer traps in South Dakota (Charles, 1961; Richardson, 1971), a rope-mesh trap 12 feet (3.7 m) square in Idaho (Rogers, 1960), rope nooses in Washington (Wadkins, 1967), and woven-wire pen traps in Montana (Lentfer, 1955; Cooney, 1946; McDowell, 1949; Casebeer et al., 1950; Stockstad, 1959; Rideout, 1974b). They have been marked successfully with sheep branding paint and colored eartags (Lentfer, 1955; Foss, 1962), and radio tracking studies were conducted in the Sapphire and Swan mountains of Montana (Rideout, 1974a, 1974c; Chadwick, 1973).

Mountain goats have been counted with the least difficulty in the early spring when they are in large groups on their winter range (Anderson, 1940; Casebeer, 1948; Brandborg, 1955). Such counts have been made from the ground and from the air with slow flying aircraft (Brandborg, 1955).

BEHAVIOR. Mountain goats are not gregarious in summer and autumn, groups of two to four individuals generally occurring in South Dakota and Montana (Hanson, 1950; Brandborg, 1955; Rideout, 1974a). Holroyd (1967) reported large groups at salt licks in summer and on bedding grounds during winter storms. Males are more frequently seen alone in

spring and summer than are females (Brandborg, 1955; Holroyd, 1967), and males and females seem indifferent to each other's presence outside of the rut except at salt licks (De-Bock, 1970; Rideout, 1974a).

Mountain goats do not engage in head-on clashes with one another during agonistic encounters as do mountain sheep; the cranial differences between Oreamnos and Ovis reflect this dissimilarity in behavior (see section on Form). Threats of the mountain goat include the horn threat, in which the head is tipped forward thus displaying the horns; the rush threat, where the aggressor rushes directly at the opponent, lowering his head as he nears him; the present threat, which is a lateral display involving head-to-flank circling; and the horn swipe, which is an upward swipe of the horns with the head tipped forward (DeBock, 1970; Geist, 1964). DeBock also described a stare threat in the adult female, which resembled the horn threat. The horn is an extremely effective weapon, and several cases of fatal injuries have been reported (Geist, 1964, 1967). The thickness of the hide in the rump region of adult males lessens the severity of wounds received during head-to-flank maneuvers (see section on Form).

The play of kids includes several of the adult agonistic interactions. The present threat is one. Mutual butting under the abdomen and head shaking are others; these resemble the adult horn swipe but involve more vigor. Mutual butting is conspicuously absent in yearlings, which have dangerous horns, and females drive them away from kids, thereby eliminating possible injury to the kids (DeBock, 1970). Neck fighting, in which one kid places its head and neck over the neck of another and tries to force it to its knees, resembles the resting of a male's head on the neck of a female in courtship (see below). Kids also exhibit mounting behavior, and play "king of the mountain" on a rock or stump.

The dominance hierarchy in nonrutting mountain goats, as reported by Geist (1964), is unusual in that adult males are subordinate to adult females and even juveniles. This circumstance has been used to formulate theories on the evolution of the cranial morphology in the mountain goat by Reed and Schaffer (1972) and Schaffer and Reed (1972), who postulated that males never fight and that no dominance is established. Geist's observations of male-female interactions outside of the rut indicated that males, approaching females in the low-stretch position (see below), are frequently repulsed by the females. Geist's findings were similar to those of Chadwick (1973), who also observed high aggression of females and yearlings toward adult males in summer. In contrast, DeBock (1970) and Rideout (1974a) found that males won 50% and 80%, respectively, of the aggressive encounters with females outside of the rutting season. The high aggression of females reported in the other areas appears to relate to high competition between the sexes for food resources (Rideout, 1974a); in the Swan Range of Montana adequate summer range is extremely limited (Chadwick, 1973).

Male-female interactions increase in October at the approach of the rut (DeBock, 1970). Geist (1964) reported that males were frequently driven off by the females at this time, whereas DeBock (1970) reported less aggression. Males tending females during the rut are relatively inactive, standing for long periods of time and feeding infrequently (Geist, 1964; DeBock, 1970). Rutting males mark vegetation with their horn glands (see section on Form), and dig rutting pits from which they paw soil back onto their flanks and belly (Geist, 1964; De-Bock, 1970). This activity is usually accompanied by urination (Holroyd, 1967), and males can be identified at a distance during the rutting season by their soiled coats which result from this behavior (Geist, 1964; Holroyd, 1967).

A courtship bout will contain some or all of the following acts, in approximately this order: 1) a male with body extended parallel to the ground, the legs bent, and tongue flicked in and out approaches a female, in low-stretch position; 2) male's approach stimulates micturation in female; 3) male noses urine and pulls his upper lip back sharply in response to the urine (flehmen; Estes, 1972); 4) if female continues receptive, male kicks her with his foreleg between or on her haunches; 5) foreleg kick is followed by repeated mountings, with male frequently resting his chin across back or rump of female between mountings; 6) intromission is achieved after several mountings (Geist, 1964; DeBock, 1970).

Mountain goats feed from dawn to mid-morning, and are inactive during the middle of the day. Late afternoon to evening is a second period of activity, and goats are frequently active throughout the night, even when there is no moon (Brand-

borg, 1955; Rideout, 1973, 1974a). In contrast, Geist (1971) believed that mountain goats were not active at night, due to poor night vision.

Low intensity vocalizations are generally emitted by adults during aggressive encounters, but observers seldom have been near enough to hear them (Rideout, 1973, 1974a) and Hibbs (1966) concluded that adult mountain goats seldom utter vocal sounds. Reported vocalizations include: a low pitched grunt (Seton, 1929; Geist, 1964); a low, soft, buzzing emitted during the low-stretch (Geist, 1964); the bleat of a female separated from her kid and the higher pitched bleat of a kid searching for its mother (Brandborg, 1955; Holroyd, 1967); a similar bleat by an adult male but lower in pitch, associated with the rut (Holroyd, 1967); a warning snort and a soft bleat by a surprised male (Hanson, 1950). Audiospectrograms of mountain goat vocalizations were analyzed by Rideout (1974a), and compared with those of *Bos*.

Bedding depressions 25 to 50 mm deep and approximately 350 by 610 mm are dug with the forefeet. A goat lies down by first kneeling, then lowering its hindquarters and rolling on the side. While ruminating, a goat usually lies on its side, extending one or both forelegs. Goats sleeping on sunny days lie on their sides with all legs extended and the eyes closed; sometimes the head is folded back along the side (DeBock, 1970). On hot days, goats frequently bed in the shade or on snowbanks (Brandborg, 1955).

A goat dustbathes while bedded. One leg is folded under the body and the other is drawn back and to the side to throw soil over the flanks and back. After dustbathing on one side the goat frequently repeats the act on the other side. The rutting-pit position is also frequently used, the goat propping itself in a sitting position with one foreleg while pawing with the other. Dustbathing most likely occurs in response to heat, irritation from ectoparasites, and discomfort from the shedding coat (DeBock, 1970).

Geist (1971) reported that mountain goats perform comfort movements only rarely, and that dustbathing has replaced movements concerned with skin care. DeBock (1970), on the other hand, described a number of comfort acts, including scratching with the hind foot on many parts of the head and neck, scratching with the horns on the back and ribs, scratching the side of the head or the throat by rubbing against the ground, rubbing on bushes and earth banks, shaking the body to remove dust or water from the pelage, and biting or licking the wool on the sides or legs. Other comfort acts that did not involve skin maintenance included yawning, in which the ears were folded back against the head, and stretching, by extending the legs and lowering the head between the forelegs, by extending the hind legs and depressing the hips, or by alternately extending either hind leg.

GENETICS. The karyotype of one mountain goat was reported (Wurster and Benirschke, 1968). The diploid number (2N) is 42 and the fundamental number is 60. There are 18 metacentric to submetacentric chromosomes and 22 acrocentric to subacrocentric chromosomes. The X chromosome is a large acrocentric and the Y chromosome a small metacentric. The chamois (*Rupricapra rupricapra*) also has a fundamental number of 60, but a diploid number of 58. "The fundamental number of 60 and the presence of Robertsonian changes as a dominating mechanism of karyotype variation seem to be characteristic for the tribe Rupricaprini, as they are for some related tribes of the Bovidae, mainly the Caprini" (Gropp *et al.*, 1970). Nadler (1968) presented one- and two-dimensional serum protein electrophoresis patterns of *Oreamnos*, and compared them to patterns seen in *Alces alces* and *Ovis dalli*. *Oreamnos* differs from *O. dalli* in its more rapidly migrating C fraction, and in possessing a second, slower transferrin band in addition to the faster band that is found alone in *O. dalli*.

ETYMOLOGY. The word *Oreamnos* is from the Greek words *Oreos*, meaning "mountain," and *amnos*, meaning "lamb." The specific name, *americanus*, is a neologism derived from the word American, and the Latin nominative suffix *us*.

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